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COMMUNICATION

THE COST OF THE ISTHMIAN SHIP CANAL

BY JOHN C. TRAUTWINE, JR.,
Philadelphia.

In a paper read before the Manufacturers' Association of Chicago on March 16, 1909, and reprinted in *Engineering News*, March 18, 1909, Lieutenant-Colonel George W. Goethals, Chairman and Chief Engineer, Isthmian Canal Commission, said:

"The estimated cost by the present commission for completing the adopted project, excluding the items left out by the Board of Consulting Engineers, is placed at \$297,766,000. If to this be added the estimated cost of sanitation and civil government until the completion of the work, and the \$50,000,000 purchase price, the total cost to the United States of the lock-type of canal will amount to \$375,201,000. In the preparation of these estimates there are no unknown factors. (These same figures are given also in the Annual Report of the Isthmian Canal Commission for the fiscal year ending June 30, 1909, page 31.)

"The estimated cost of the sea-level canal for construction alone sums up to \$477,601,000, and if to this be added the cost of sanitation and civil government up to the time of the completion of the canal, which will be at least six years later than the lock canal, and the purchase price, the total cost to the United States will aggregate \$563,000,000. In this case, however, parts of the estimate are more or less conjectural—such as the cost of diverting the Chagres to permit the building of the Gamboa dam and the cost of constructing the dam itself.

"The majority of the Board of Consulting Engineers estimated that from ten to thirteen years would be required for the completion of the sea-level canal. The Isthmian Canal Commission and the then chief engineer fixed the time from eighteen to twenty years."

In an interview published in *The Engineering and Mining Journal*, July 5, 1879, John C. Trautwine said, respecting a sea-level canal at Panama: "Taking into consideration the loss of interest on money and the cost of damages from floods, it is very doubtful whether

five hundred millions of dollars and twenty-five years of time would suffice to construct the Panama Canal."

In a letter to the *Polytechnic Review*, August 19, 1876, Trautwine estimated the cost of a sea-level canal, 100 feet wide at bottom, 200 feet wide at water line, and 30 feet deep, either by the short San Blas route (involving a tunnel) or via the Atrato River and the Bay of Cupica, at about \$300,000,000.

It will be seen that, considering the smallness of the canals which Trautwine had in mind, and on the other hand, the relative inefficiency of the appliances then at the service of the engineer, Trautwine's estimates are remarkably in accordance with those of the present day; but, in a paper entitled "Important Elements in Naval Conflicts," published in *THE ANNALS of the American Academy of Political and Social Science*, July, 1905, the late Admiral George W. Melville said:

"The latest estimate as to the cost of an isthmian sea-level canal is about \$230,000,000. In connection with the cost of such a water-way, it may be well to remember that Trautwine, about fifty years ago, estimated the cost as about \$16,000,000, or about seven per cent of the latest estimate."

How Admiral Melville came to make this very glaring, though of course unintentional, misrepresentation of Trautwine's estimates is indicated in the following extract from the latter's "Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America," published in the *Journal of the Franklin Institute*, March to November, 1854, or "about fifty years ago," relatively to the date of Admiral Melville's paper. In this document, estimating the cost of an insignificant water-way (*with locks*) "for steamers of about six feet draft, from ocean to ocean," he gives the following "supposititious" figures:

Twenty miles, constructed through the Napipi swamps	\$16,000,000
Two miles of deep cutting, averaging 150 feet in depth	8,000,000
Eight miles in better soil, and less unhealthy locality..	1,600,000
Deepening the Atrato, thirty-nine miles.....	7,800,000
Stopping up the upper end of Caño Tadia.....	1,000,000
Improvements at Boca Urabá.....	1,000,000
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	\$35,400,000
Interest on gradual expenditures during fifteen years	
of construction.....	15,000,000
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	\$50,400,000

It is to be noted especially that, although this estimate allows for "the exorbitant salaries necessary to induce officers to live (or, rather, to die) in these infernal regions," Trautwine speaks of this \$50,400,000 as "a sum which I regard as *totally inadequate for the purpose*," namely, for constructing "a route for steamers of about six feet draft."

It will be noticed, however, that, in this underestimate, the first item does happen to be \$16,000,000, less than one-third of the total, and it appears that Admiral Melville, or his informant, must have mistaken this single item for the total; but it must still be remembered that this underestimate of \$50,400,000 referred to a work which would have been wholly insignificant in comparison with even the canal with locks, now nearing completion at Panama, to say nothing of the far more formidable proposition of a sea-level canal.

Even the thirty-foot canals, which Trautwine had in mind, are trifles compared with the forty-five-foot channel now being constructed. That his estimates (\$300,000,000 for San Blas or Atrato, and \$500,000,000 for Panama—all sea-level) for so small a channel, are so nearly those estimated to-day for the much larger work now under construction, is at least partly explained by the facts: (1) that the present sanitation of the Canal Zone had not then been thought of; and (2) that no conception could then have been formed of the machinery and methods now available for such tasks.

For the Atrato route, at least, Trautwine based his estimate upon the use of *wheelbarrows*, saying that "horses and carts could not be employed."

Even Colonel Goethals might well have hesitated to attack the Culebra cut with wheelbarrows.